ENGINEERING ABSTRACTS

PACKARD RADIAL DIESEL ENGINE

A radial Diesel type, air-cooled engine, built by the Packard Motor Car Co., was recently used in a test flight in a standard Stinson-Detroiter monoplane. It was the first time that an engine of this type has been in the air.

The engine, which is rated at 200 hp., weighs less than three pounds per horsepower. Details of the design have been withheld pending final experimentation and the start of production, which is not expected for several months.

Aircraft engine manufacturers have been experimenting with engines of this type as means of eliminating troublesome accessories and lowering fuel consumption with increased cruising radius.—*Automotive Industries.*

SCIENTIFIC WAR ON RUST

Using the whole United States as a laboratory, three experts of the U. S. Bureau of Standards have undertaken a gigantic experiment to find the cause and cure of corrosion, the most common manifestation of which is rust. Corrosion destroys some 21,000,000 tons of iron and steel each year, probably the greatest waste industry suffers.

To study the processes of corrosion in different soils, the experimenters recently buried 10,000 specimens of various kinds of metal pipe in forty large cities. Though most of them will remain in the ground for four years, some 2000 pieces already have been removed and examined in the laboratory. Among valuable facts already learned are these:

The rate at which metal rusts depends largely on the nature of the soil. For example, in muck found near New Orleans and in various slit loam soils in Ohio and about Kansas City, the rate was extremely high. In other places, notably in gravelly, sandy loam near Seattle, Wash., rust was almost negligible.

Galvanized steel, heretofore considered more resistant to rust than the bare metal, proved less resistant in one instance, when samples of both were placed in the same muck soil.

Copper and brass withstood the test better than any other metals. Lead resisted corrosion well, though in a few cases it became deeply pitted.

An important phase of the tests is a study of the effects of stray electric currents in the ground, such as come from power lines, which corrode metal by the chemical action known as electrolysis.

One of the immediate valuable results will be data telling the best type of pipe to lay in a given kind of soil.—*Popular Science Monthly.*

BEST EFFICIENCY WITH SYNCHRONOUS MOTORS

Synchronous motors are being used extensively in industry for a great many different drives. On this type of motor the power factor can be controlled and, to a certain degree, the efficiency. These motors are designed for operation at 80 per cent leading power factor or unity power factor at full load. With the field adjusted to give rated power factor at full load, the power factor will decrease to the leading side when the load is less than rated value. This, however, in many plants is not objectionable.

When the load is made up almost or entirely of synchronous motors, the unity power factor is usually installed. In such cases, operating the motors at unity power will give the best efficiency at all loads. The field losses can be reduced some by reducing the field current with the field rheostat. When the power factor is decreased below unity the stator current is increased for a given horsepower output, consequently the copper losses in the winding are increased. These losses increase faster than the field losses are decreased, therefore the net result is a decrease in efficiency.

Where two or more motors are excited from a common source, the exciter voltage should be carried as low as possible to give the desired power factor on the motors. If the motors are not identically alike, the exciter voltage should be adjusted to a value that will give the correct power factor on the motor requiring the highest excitation voltage. Then adjust the power factor on the other motors by their field rheostats. When operating under this condition the field resistance will all be cut out on one motor and there will be a small amount of resistance in series with the fields of the others. This method of operation allows the minimum losses in the fields of both the exciter and the motors to obtain the desired power factor. If the exciter voltage is made too high, the losses in the field rheostats of the motors may total a surprising waste of power in a year. —*Power.*

NEW 24 CYLINDER ENGINE DEVELOPS HIGH POWER

What is believed to be the largest airplane engine built thus far is the 24-cylinder 1500 hp. air-cooled type recently completed by the Allison Engineering Co., of Indianapolis. The engine is similar to those used at the Army Air Service experimental station at Wilbur Wright Field, Dayton, Ohio, and was ordered by the government to determine if one large engine in a plane is more efficient than three smaller ones for bombing and similar type planes. After block tests the engine will be installed in an army bomber plane originally designed for three smaller engines.

The new engine, designed and built entirely in the Allison Shops, is known as the Allison X-4520, the figure 4520 representing the cu. in. piston displacement. It is of the perfect X type, having four rows of six cylinders each, the rows extending on four sides from a central crankshaft. The weight is 2800 lb., or less than two pounds per hp. The gasoline consumption at high speed is 125 gal. per hour.—*Aviation.*

PETROLEUM HYDROCARBONS

At a meeting of the Petroleum Division of the American Chemical Society, Edward W. Washburn, Hohs H. Bruun, Mildred M. Hicks, and Martin Shepherd presented a paper entitled, "Apparatus and Methods for the Separation, Identifi-

cation, and Determination of the Chemical Constituents of Petroleum." The apparatus referred to in the paper includes the following:

1. A new design of rectifying column plate which combines the bubble cap and reflux drain.
2. A rectifying still with a 20-plate column and with means for independent controlling and measuring the temperature of the plates. The still is designed for distillation in a stream of an inert gas (CO_2) without boiling. It is provided with a purifying train for the CO_2, with a series of condensers with stepped temperatures down to 80°C., and with a final absorber for the CO_2.
3. A set of all-glass rectifying stills for vacuum distillation, which have vacuum-jacketed columns, mercury-sealed stop-cocks. These stills have provision for intermittent feeding of liquid and withdrawal of fractions during the distillation. They are heated by immersion in an electrically heated bath of nickel shot.
4. Various types of molecular stills by means of which distillation can be carried out at temperatures at which the vapor pressure at the distilling surface is extremely low, even as low as 0.000001 mm. of mercury if necessary.
5. Methods and apparatus for fractionation by crystallization or melting.
6. An apparatus for combustion analysis with special provision for purifying the oxygen employed and with all rubber connections eliminated. With this apparatus the combustion of a hydrocarbon can be carried out with the following accuracy: Per cent C and per cent H each to about ± 0.02. This makes it possible to determine with certainty the value of x in the formula $C_nH_{2n} + x$ for any hydrocarbon up to C_{100}.

The change in the iodine number of the "wax-distillate" fraction of a petroleum oil produced by heating for different periods and at different temperatures up to 370°C in (a) air and (b) H_2N_2 and CO_2 respectively has been determined, and it is shown that in the absence of air this change is greatly reduced, thus making it possible to distill petroleum at high temperatures without cracking provided all air is excluded.—*Automotive Industries.*

MILLS FOR PULVERIZING COAL

Two popular forms of mill for coal pulverization are the screen and the air-separation types. These names designate the methods used to classify the material leaving the mills. Screen mills operate satisfactorily with dry material, but may clog up with damp coal. The air-separation type also may function badly on wet coal if not properly vented. When vented, the dust from such vents may prove difficult to handle.

Several plans have been developed to carry out the drying of the coal in the air-separation mill itself by circulating heated air through it. If this air cannot be delivered to the furnace, a small quantity of highly pre-heated air may be used. However, if the air from the vent can be used as primary air to the burners, as is now done in several plants, then large volumes of pre-heated air may be used in the mill. This method eliminates coal driers and simplifies and cheapens the layout. Reports indicate that the temperature of the parts of the mill is little higher than when no heated air is used, hence lubrication troubles have not increased.

Most American plants are built with the suction fan on the air separation system placed to draw air through the mill and deliver it to the cyclone. This fan handles both coal dust and circulating air. The abrasion of the coal dust rapidly wears out the fan blades. In Europe this fan has been placed on the return pipe. It draws air from the cyclone and forces it through the mill. The air at the fan carries only some very fine dust that has not been separated in the cyclone. Fan maintenance is therefore markedly less, and the fan is said to require less power than with the usual arrangement.

The use of air drying in the pulverizing mills and of the vent as primary air will greatly simplify pulverized-coal systems, but will require that the mills shall be placed beside the boilers. If a unit system is used, the drying air will, of course, be delivered from the mill direct to the furnace.

These trends of development are in the right direction. Industry wants a simplification and reduction of cost of pulverized-coal systems.—*Power.*

LARGEST POWER SHOVEL IN THE WORLD

An electric power shovel, with a dipper that will gouge out fifteen cubic yards, or nearly twenty-four tons of earth in one bite and lift it to the top of a ten-story building, is being constructed by the Marion Steam Shovel Company of Marion, Ohio, and electrically equipped by the General Electric Company. The large shovel will be used in the open-pit mining of coal in Illinois.

Its scope of operations will be unusually wide. The shovel boom will be 120 feet long and the dipper stick 82 feet long. Thus, it will be able to lift to a height from 90 to 100 feet, and will be able to reach out over a radius of 150 feet from the center of operations, covering a circle 100 yards in diameter. If this shovel was placed in the center of the football field in the stadium it could dig out the entire playing field, deposit the dirt in the seats, and could continue its digging in this manner to a dept of more than 75 feet. —(New York Times).

HE WAS NOT A GLOOM

The storm was increasing in violence and some of the deck fittings had already been swept overboard, when the captain decided to send up a signal of distress. But hardly had the rocket burst over the ship when a solemn-faced passenger stepped on to the bridge.

"Captain," he said, "I'd be the last man on earth to cast a damper on anyone, but it seems to me that this is no time for letting off fireworks."

THE CANDID DOC

"Doctor, don't you find it inconvenient to travel miles to see me?"

"Oh no; I have another patient near here, so I get the chance to kill two birds with one stone."

CONSCIENTIOUS WITNESS

The old time practice of kissing the bride received a jolt at a recent down State wedding when an awkward-looking guest was asked if he had kissed the bride and replied: "Not lately."